



Everything you probably never wanted to know about

# WORMS!



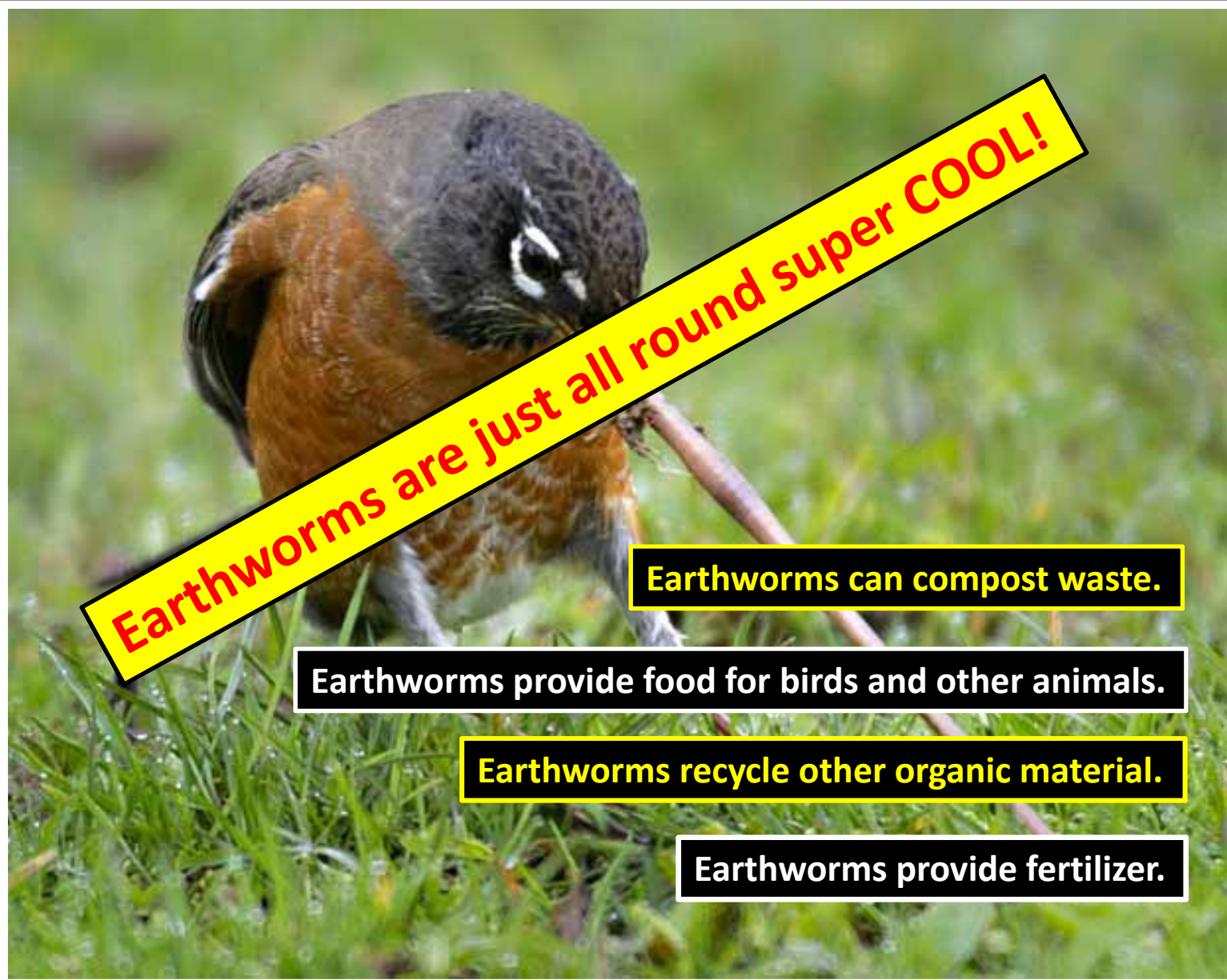








# Why do you think you like earthworms?



**Earthworms are just all round super COOL!**

**Earthworms can compost waste.**

**Earthworms provide food for birds and other animals.**

**Earthworms recycle other organic material.**

**Earthworms provide fertilizer.**

# Why you might want to reconsider how you feel about earthworms.



Earthworms are an invasive species.

Earthworms upset soil chemistry.

Earthworms make it more difficult for native plants and insects to thrive.

Earthworms can damage forests.

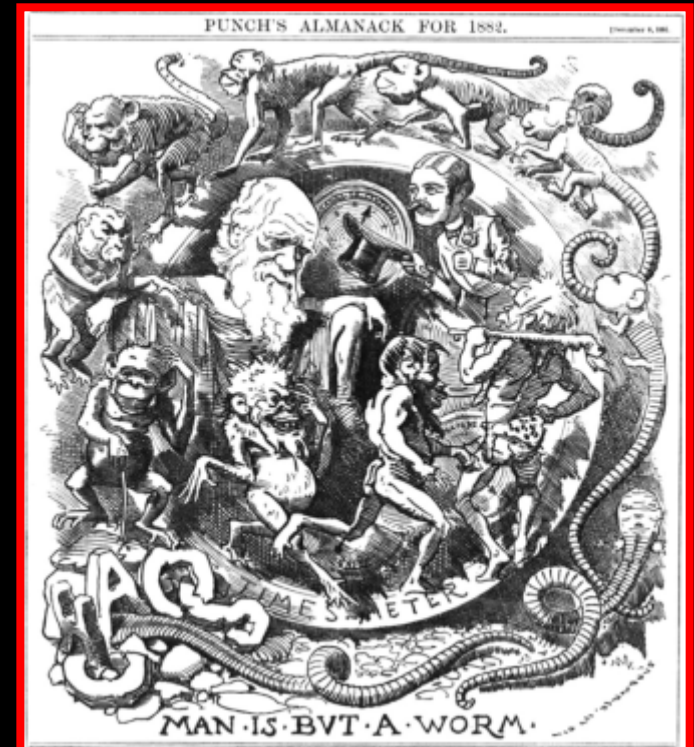
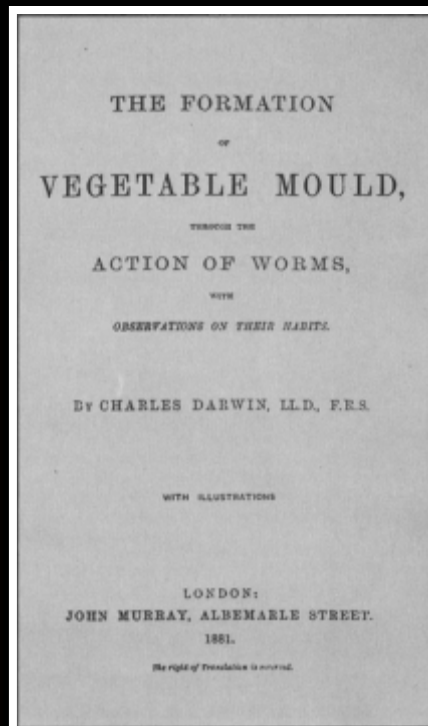
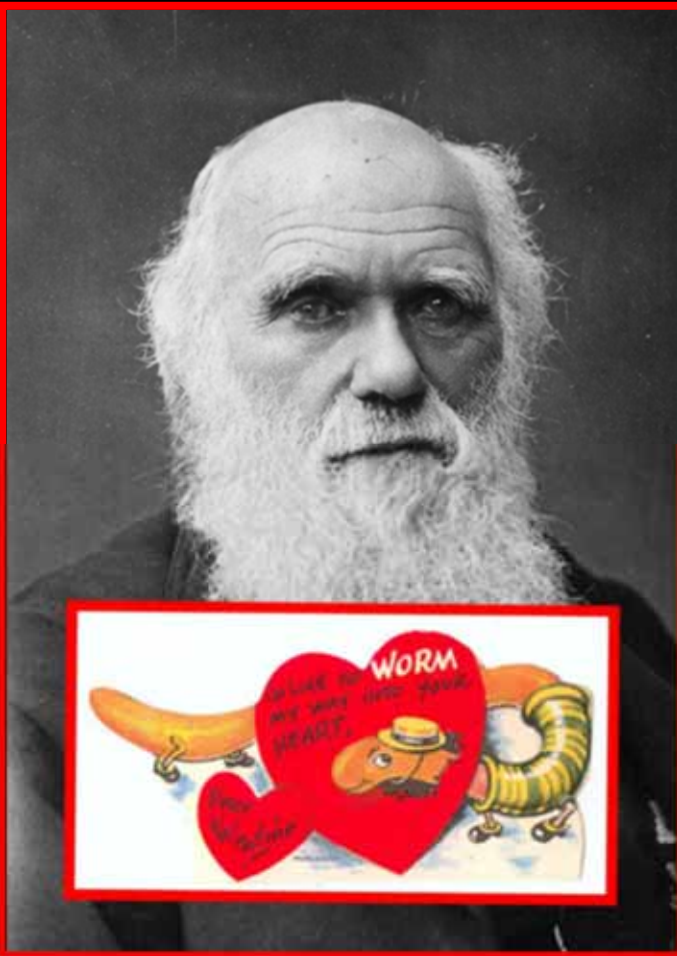


# WHO OPENED THE CAN?



In his last botanical work, *The Formation of Vegetable Mould, Through the Action of Worms*, which was published 6 months before his death in 1881. \_\_\_\_\_ demonstrated the service that worms perform in digesting leaves and recalculating organic matter.

Charles Darwin considered the earthworm the most influential creature on the planet.



**They are ubiquitous in all but the driest of regions of the world. There are about 9000 species of worms both aquatic and terrestrial although only a few species are commonly known.**





**ANNELIDS** are segmented or ringed worms

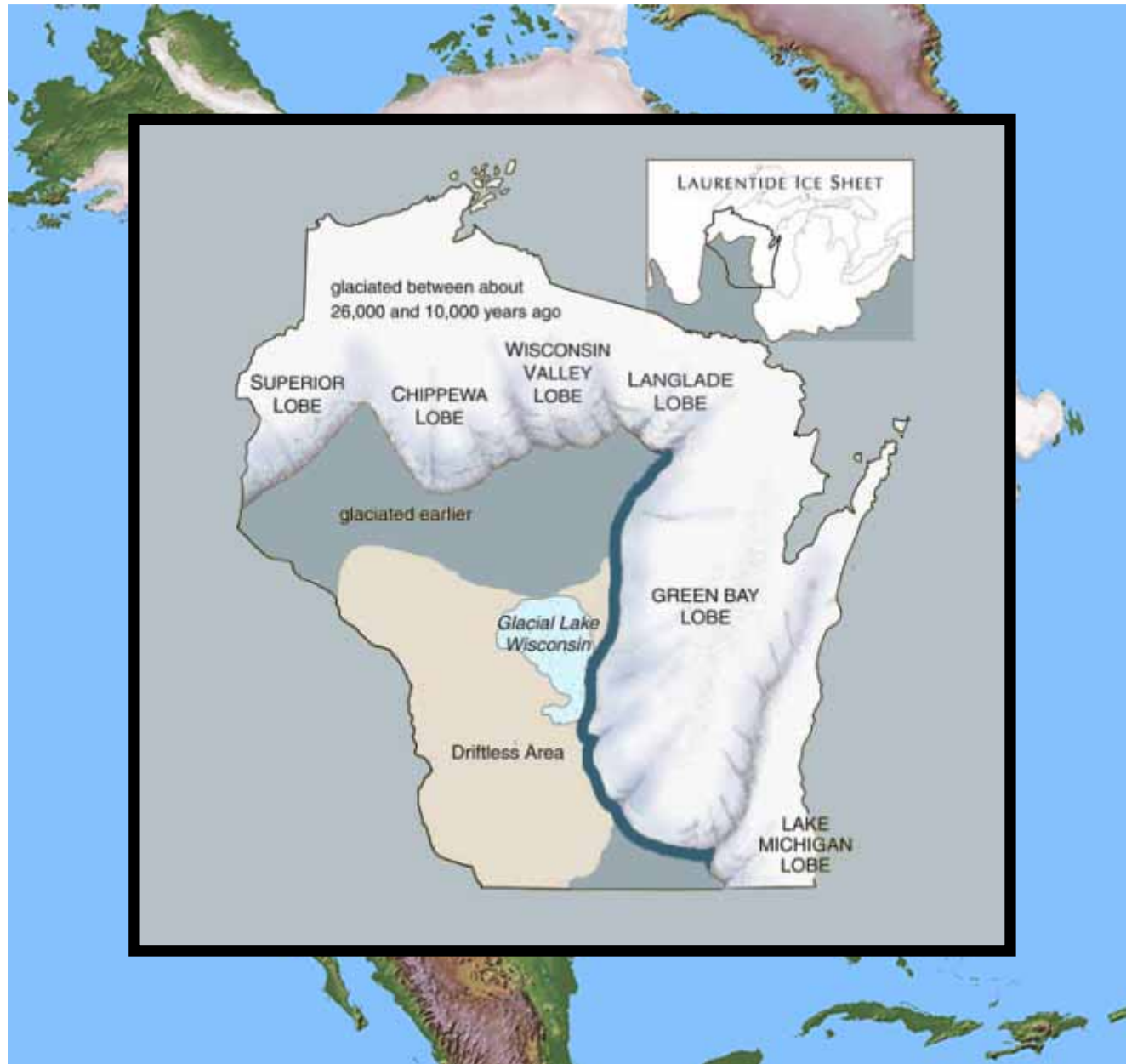
They are amongst the most ancient of terrestrial animals, their ancestors emerging in the pre-Cambrian some 600 to 700 million years ago.

They pre-date the invasion of fungi, land plants, insects (400 to 500 million years)

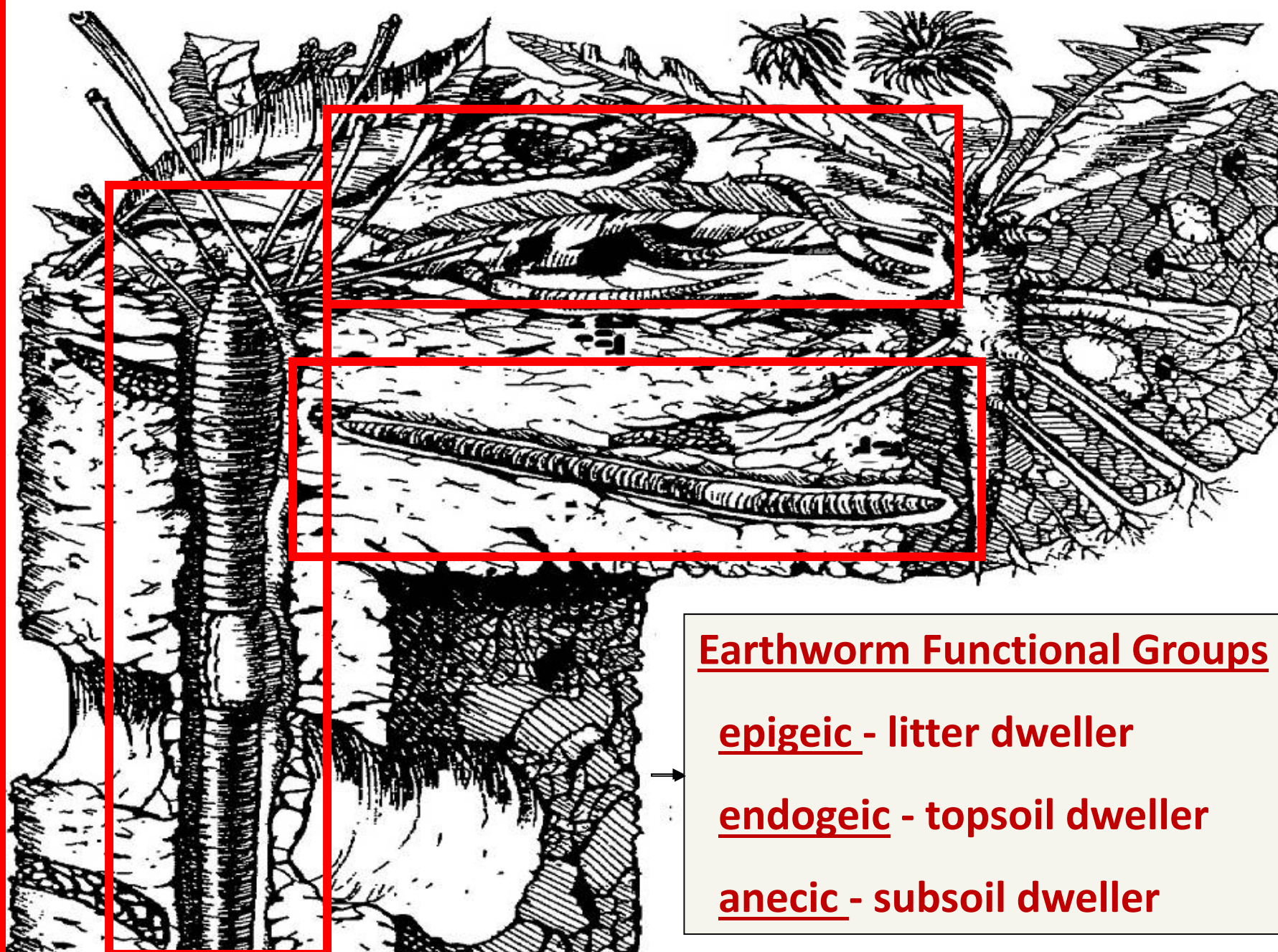
Dinosaurs and mammals (200 million years)

Hominids (4 million years)

**Worms in WISCONSIN...**



**Few native earthworms exist in the northern-most reaches of the continental United States. Most species were forced south in the last major glaciation, which ended 10,000 years ago.**



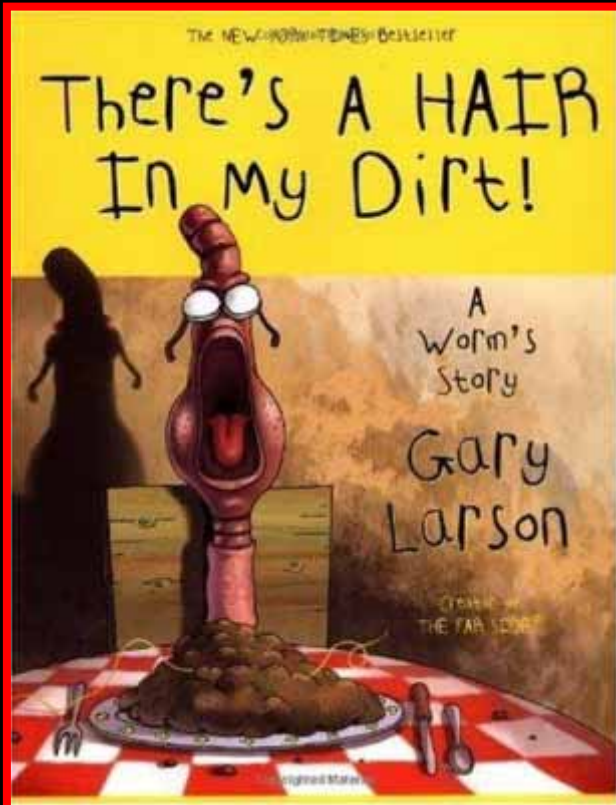
Earthworm Functional Groups

epigeic - litter dweller

endogeic - topsoil dweller

anecic - subsoil dweller

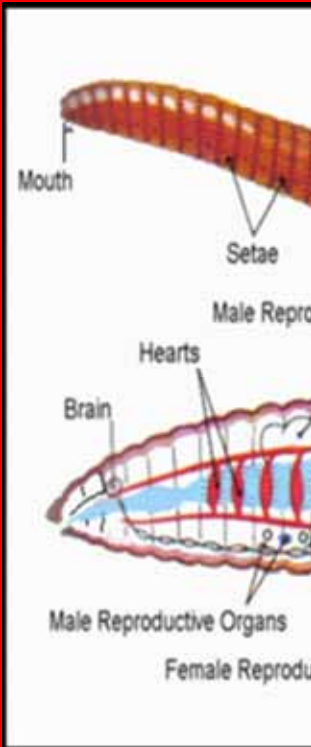
# Earthworm Ecology



**Worms eat dirt. They are detritivorous where they feed on decaying organic matter (leaf litter) and geophageous (dirt) and feed mainly in the soil layers.**



# Earthworm Biology



**Earthworms are promiscuous, polygamous, hermaphrodites but some can reproduce parthenogenetically.**

# Lumbricus terrestris

Night crawler



# Lumbricus rebellus

Leaf worm



# Aporrectodea caliginosa

Pink nosed worm



# Eisenia fetida

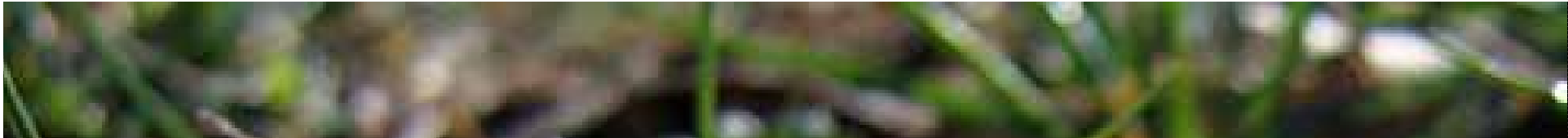
Red wiggler



# Dendrobaena spp.

Small leaf worm

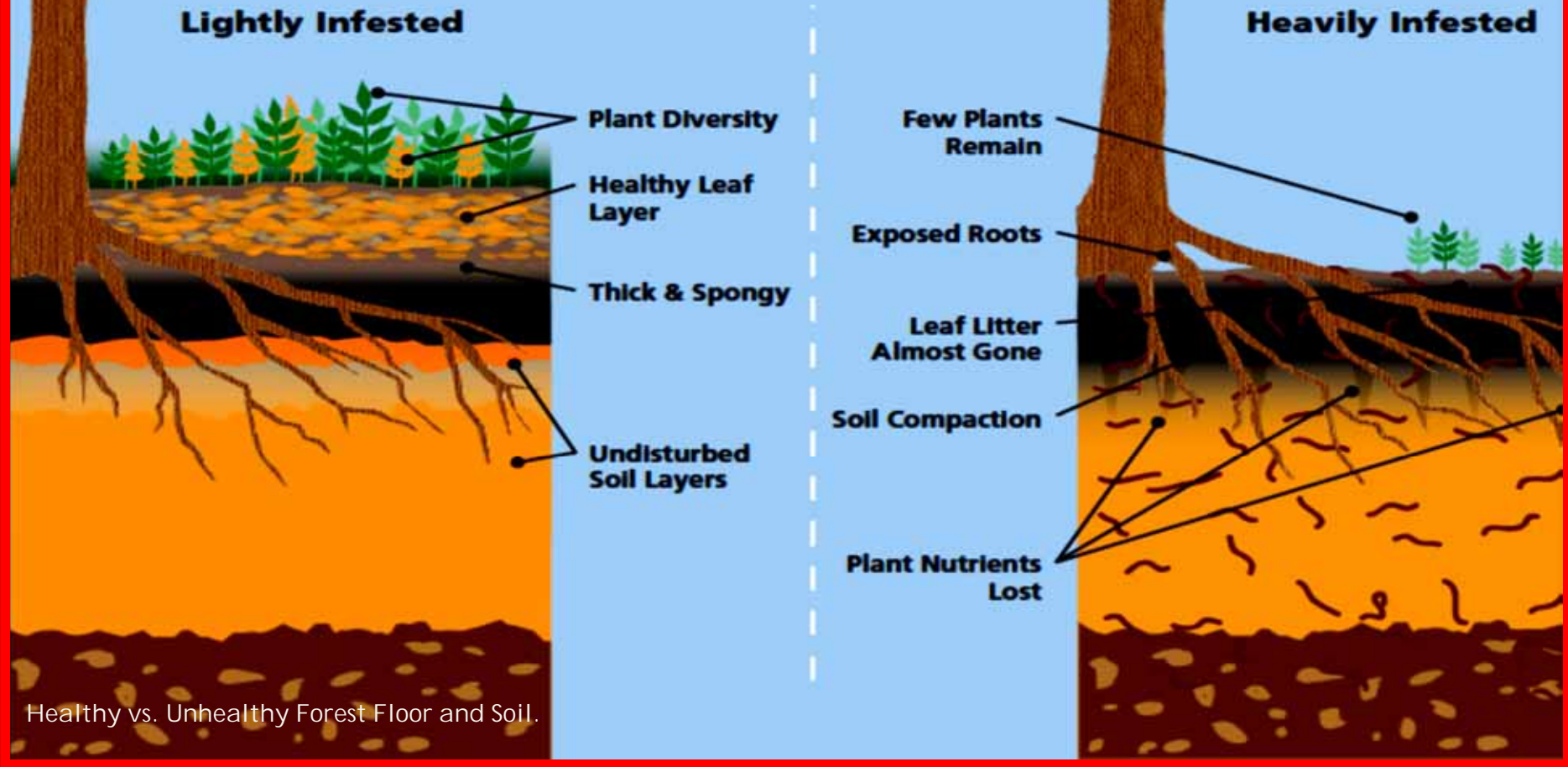




**If they are widespread why are they a problem?**



# What Happens to the Woods?



Healthy vs. Unhealthy Forest Floor and Soil.

Earthworms have considerable capacity to change the nature of their environment to suit their survival. Ecological requirements (moisture, temperature, and food supply) greatly influence the rates of reproduction and growth.

# They can be very damaging

Earthworm droppings denser than the native soils compacting the forest floor rather than aerate it.

Earthworms impact seed bank composition's through germination and seedling survival.

Research shows degraded root structures and fewer native seedlings in forests infested with earthworms.  
(\*slight variation depending on worm species and functional group)





**When a forest becomes heavily infested with earthworms the leaf litter is depleted and the soil is vulnerable to invasive species which in turn causes a decrease in the diversity of native plants and animals.**



**Healthy, undisturbed forests are typically dynamic ecosystems anchored in a complex soil structure that teems with macro- and microscopic life and the key to health in our state's forest resides in a rich fungal based soil that slowly decomposes its organic matter.**

# Criteria for assessing invasive earthworm species

## Propagule pressure

- Frequency and inoculum size of introductions
- Parthenogenesis

## Habitat matching

- Characteristics of native habitat
- Likelihood of introduction into matching habitat
- Ecological characteristics

## Invasion history

- Location of species origin
- Current distribution
- Previous invasions
- Types of habitats invaded
- Rate of dispersal

## Disease vector potential

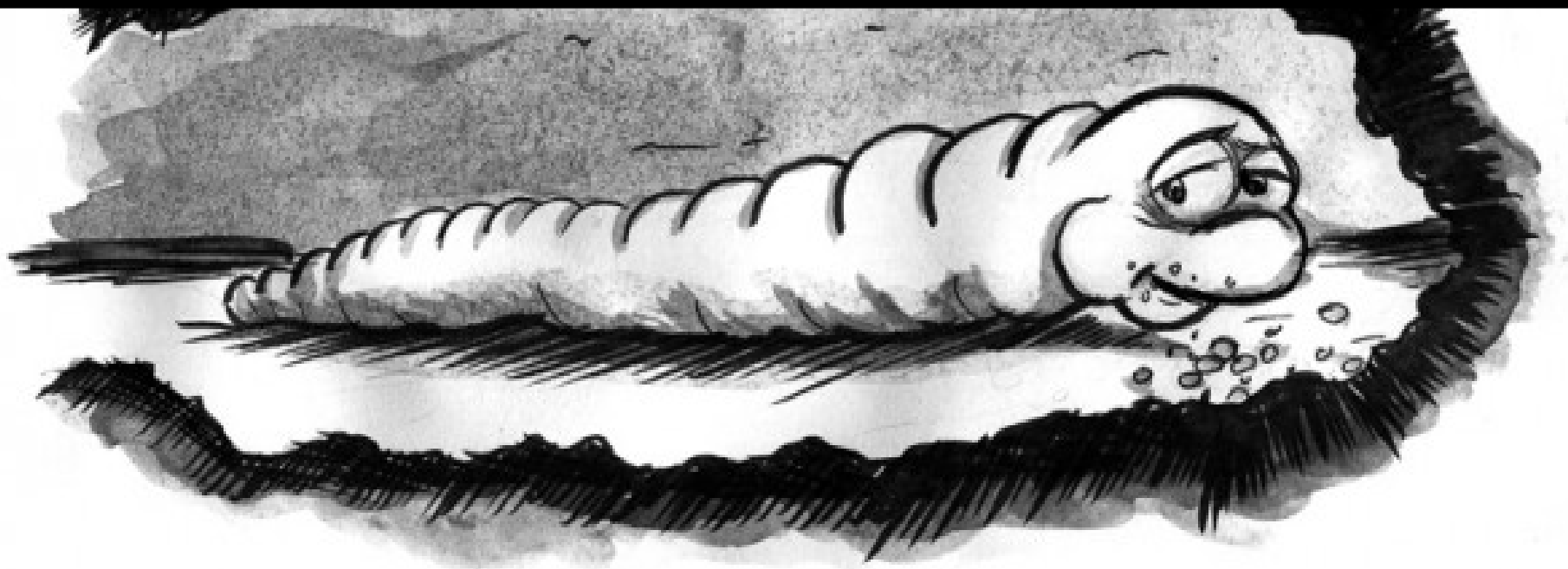
- Known or suspected pathogens carried
- Incidence of potential earthworm-borne diseases in region of export.





E is for  
Earthworm

I know you agree... there is nothing more EXCITING!





**What about those  
other WORMS...**

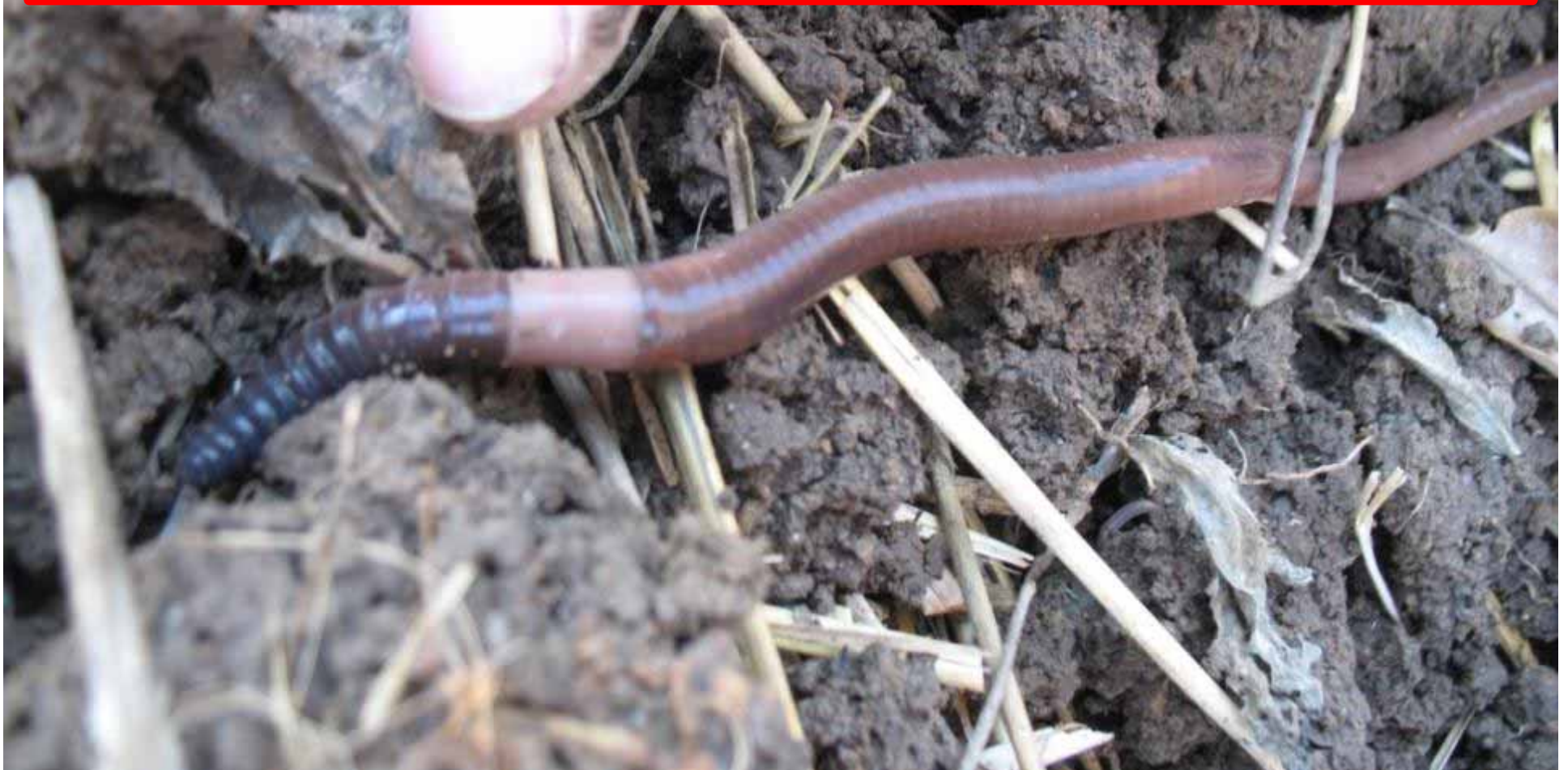
# Amynthas spp.

Jumping worm, Crazy Worm, Snake Worm, Alabama Jumper

- They are a **RESTRICTED** species in Wisconsin under Invasive Species Rule NR 40.  
[dnr.wi.gov/topic/invasives/classification.html](http://dnr.wi.gov/topic/invasives/classification.html)
- The first population was identified in 2013.



**Jumping worms in the genus *Amyntas* are currently invading areas around the globe, including North America, Central America, Europe and now WISCONSIN.**





While the invasion of European earthworms into North America is recognized and studied in the United States, the secondary invasion of Asian species have been little realized, detected or studied until recently and currently are not at all well understood.

# Amynthas spp.

Jumping Worm, Crazy Worm, Snake Worm, Alabama Jumper

## Characteristics

- Darker in color – appearing almost gray
- Glossy smooth skin
- Light milky white clitellum smooth to the body
- Very active, thrashing and jumping
- Moves like a snake
- Sheds its tail when handled
- Parthenogenic – asexual reproduction so it only takes one worm to start a family.

## Biology & Ecology

**WHY IT'S GOING TO BE A PROBLEM?**

- Reaches maturity in 60 days much faster than Lumbricidae species at 120 days – thus allowing for 2 hatches a season.
- Voracious appetites
- Highly adaptive to temperature changes
- Cocoons winter over
- Adaptive, non-particular to habitat types
- Produces a unique soil signature
- Outcompetes /pushes out, infects, poisons? Non-native European species of earthworms.





**A single Jumping worm or cocoon stowed away in a potted plant can go home with a customer and start a new infestation.**

**Moving soil from one place to another, the horticultural trade can facilitate the passive spread of invasive earthworms.**



# HOW ARE THEY SPREADING?

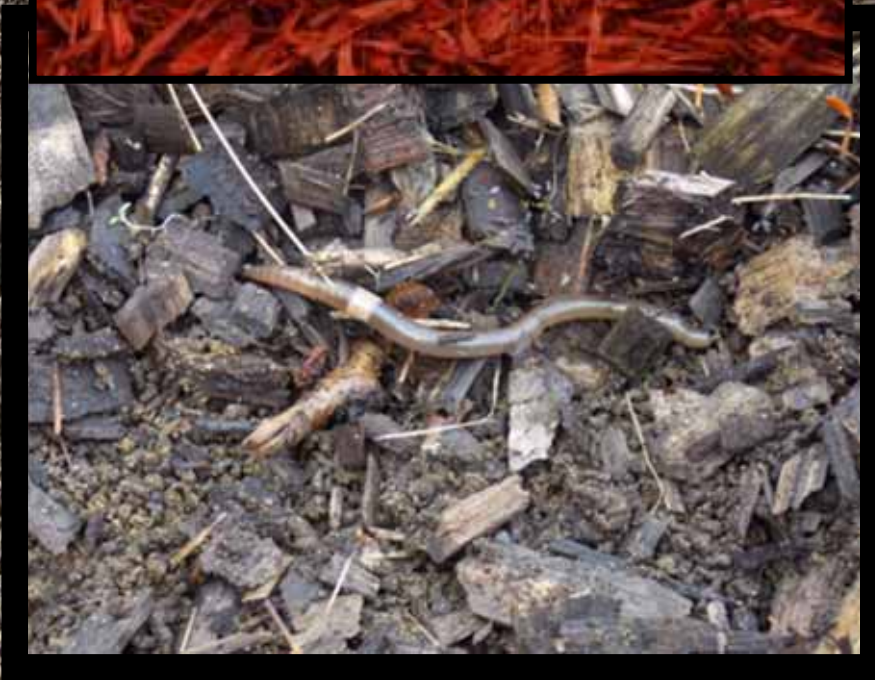


Earthworms in the genus *Amyntas* appear to be closely associated with horticulture.





# HARDWOOD MULCH

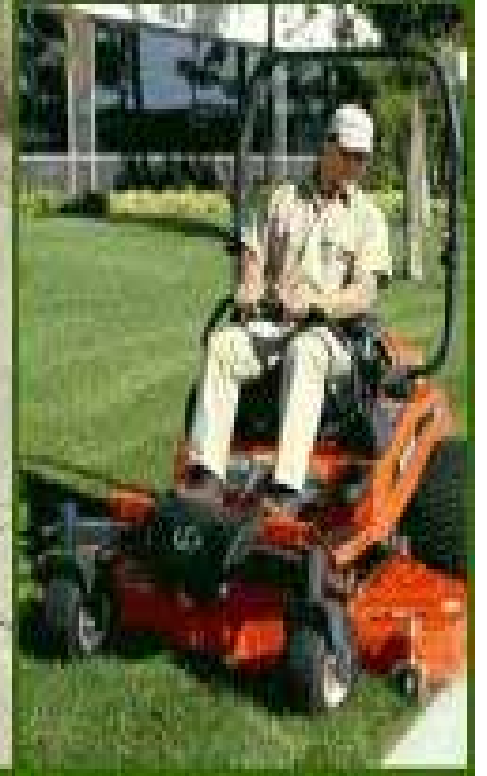
















**Dispose of Bait Worms in the Trash**

**Contain Your CRAWLERS!**

**Keep Worms OUT of Wisconsin's Woods!**

[dnr.wi.gov/invasives](http://dnr.wi.gov/invasives)

FR-494a-2012



# WHO GOT INVOLVED?

- Homeowners
- Gardeners
- Composting (Individuals)
- Mulch (Individuals, Organizations)
- Landscapers
- Nurseries
- Cities, Towns, Municipalities

**EVERYONE**

# WHAT DID WE DO?

## Recommended BMPs & Reasonable Precautions

Reasonable precautions means intentional actions that prevent or minimize the transport, introduction, possession or transfer of invasive species. Reasonable precautions include but are not limited to **BEST MANAGEMENT PRACTICES practices (BMPs)** for invasive species.

# Reasonable Precautions

- Cleaning
- Mulch onsite
- Mow leaves
- Inspect plants before you purchase
- Buy certified soil, mulch, and compost. Know the origin

**Common sense**

# BMPs

- Watch for worms and signs of their presence.
- Educate yourself, and others to recognize Amynthas.
- Only use, sell, plant, purchase or trade landscape and gardening materials and plants that appear to be free of Amynthas.
- Only sell, purchase or trade compost that was heated to appropriate temperatures and duration following protocols for reduction in pathogens (PFRPs - detailed under NR 502.12)
- Arrive clean, leave clean. Clean soil and debris from vehicles, equipment and personal gear before moving to and from a work or recreational area.

---

---

# GREEN INDUSTRY CRAZY WORM REASONABLE PRECAUTIONS

---

Developed for nursery, garden center and landscape contractor professions.

---

---

## 1. PROPAGATION AREAS

---

- Remove leaf debris from facilities and dispose of at a specified holding/compost site.
- Dispose of culled plants at the proper site- compost, bury or burn.
- Clean soil from all tools, boots and gloves before entering the propagation facility or moving from one site to another.
- Inspect all incoming plant material, place in quarantine area for acceptable time before introducing into general population.
- Clean large equipment and trucks as needed before returning from an offsite location.

---

---

## 2. CONTAINER GROWING AREAS

---

- Only use properly prepared compost in container mixes.
- Keep soil media mixing site and media bins free of debris, clean as necessary.
- Clean all equipment between mix batches. Only allow mix equipment, authorized trucks and personnel in mixing areas.
- Inspect all mix ingredient purchases.
- Dispose of culled plants in proper location.
- Produce container plants between an air gap or effective barrier between container and soil surface.

---

---

## 3. FIELD GROWING AREAS

---

- Do not accept or spread clean leaf debris or yard waste from outside sources in growing fields unless it has been properly composted.
- Clean equipment and trucks before entering new farms to care for plant nursery stock.
- Inspect all plant material for organisms before planting, during the growing season and before harvest.
- Scout and monitor soil for organisms on an annual basis.

---

---

## 4. SHIPPING/RECEIVING AREAS

---

- Quarantine all incoming plant material until inspected.
- Clean debris from trucks and dispose of in authorized location.
- Heal balled stock in gravel, properly composted material, or wrap balls in plastic or leave exposed to open air to discourage pests.
- All plants should be stored and held using an air gap between the soil and plant/container or on an effective surface barrier limiting soil contact.
- Inspect all plants before shipping off site.

---

---

## 1. CULL PILES AND SITES

---

- Locate cull piles in separate/isolated areas and always away from sensitive naturalized areas. Always use specified waste sites when disposing of materials (burn pile, burying or composting).
- Do not accept yard waste from outside sources.
- Cull piles should be separated/isolated from all other areas of the facility such as growing areas, and clean media mix components. Take precautions to prevent cull materials from being inadvertently dispersed or moved from the localized cull site. (e.g. wind, rain, etc.)
- Landscape waste must be disposed of at proper cull sites.

---

---

## 2. BIOSECURITY (PRODUCTION AREAS EXCLUDING PUBLIC RETAIL AREAS)

---

- All visitors must check in to main office before entering any of the production areas.
- Employees must clean soil from clothes, gloves and shoes before moving from one designated production area to another.
- Visitors must observe company policy when entering into areas of production. (foot and vehicular traffic)
- All visiting vehicles should report to an entry specific site before going to deliver or load and should be inspected for contaminants.
- Tarp all loads that represent risk in spreading potential threats.
- Educate and train all personnel of potential risks to nursery production areas (pests, disease, etc.).

---

---

## 3. RE-USE OR RECYCLING CONTAINERS AND BARRIERS

---

- Recycle-Remove excess soil from containers and place soil in cull pile.
- Re-use-Clean and inspect materials before re-use. Properly dispose of nonrecycled materials according to local ordinances.

---

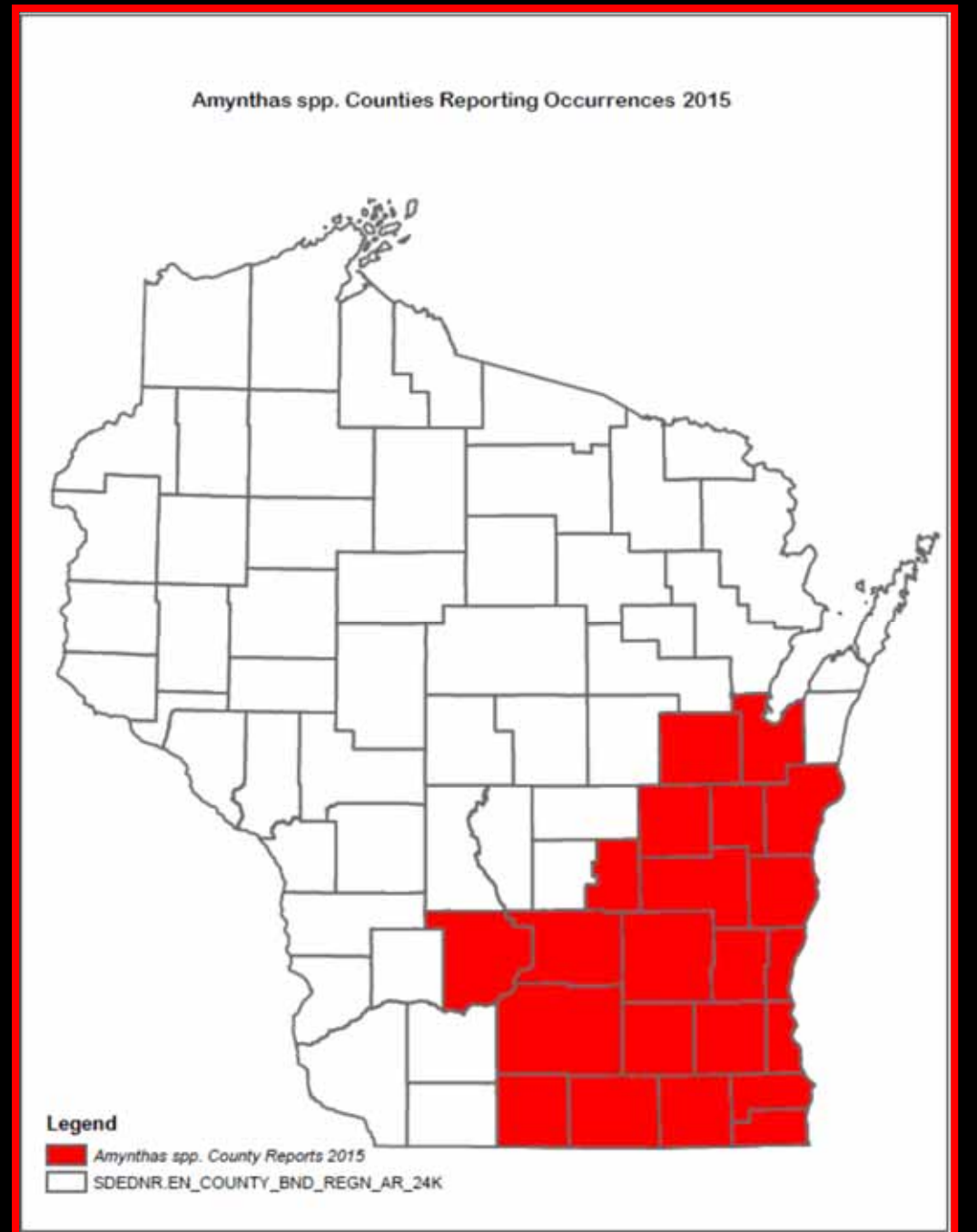
---

## 4. GENERAL LANDSCAPE CONSTRUCTION PRECAUTIONS

---

- Landscape waste must be disposed of at proper cull sites.
- Clean soil from all tools, boots and gloves before entering the propagation facility or moving from one site to another.
- Clean large equipment and trucks as needed before returning from an offsite location or in the designated cull pile site.
- Inspect all incoming plant material, place in quarantine area for acceptable time before introducing into general population.
- Heal balled stock in gravel, properly composted material, or wrap balls in plastic or leave exposed to open air to discourage pests.
- All plants should be stored and held using an air gap between the soil and plant/container or on an effective surface barrier limiting soil contact.
- Inspect all plants before shipping off site.

# WHERE THEY'VE BEEN REPORTED



# Does anything eat them?



The early bird  
ate too many worms  
and died





# CAN WE KILL THEM?

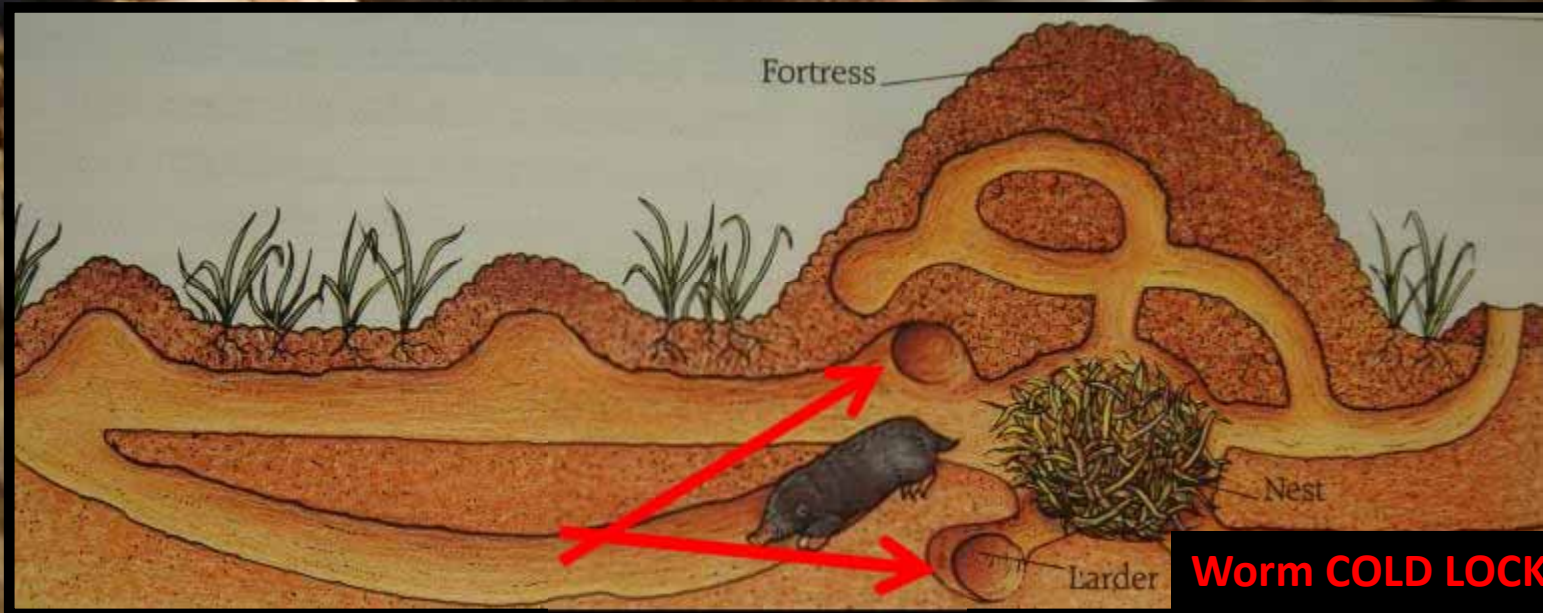
**We're working on that...**

Research indicates that tea seed meal, a natural by-product of tea oil manufacture, and containing natural surfactants called saponins, is effective for expelling earthworms. The mode of action is similar to that of mowrah meal, a mainstay for managing earthworms on golf courses a century ago. Tea seed meal has been formulated into an organic fertilizer (Early Bird™ 3-0-1) suitable for use on fairways and putting greens.



# There are other options...

The Common mole  
*Scalopus aquaticus*



**Worm COLD LOCKER**

# Questions?

